

BLACKFOOT

GLACIER COUNTY

The Blackfoot site is located four miles northeast of Browning at 48 35 20 N and 112 52 35 W (Site No. 53 on Map II-1). Elevation at the site is 4,280 feet. This monitoring site is part of the Wind Regional Energy Assessment Program run by Oregon State University for Bonneville Power Administration.

The site is in a rolling grasslands area near the Rocky Mountain Front. It is less than 20 miles east of Glacier National Park. The site is representative of a large area. Access to the area is reasonable, with an all weather highway running through the middle of the high wind area. Dirt roads criss-cross the area. Winter access is sometimes hampered by drifting snow and severe weather conditions.

The site is located on the Blackfeet Indian Reservation. Electrical service in the area is provided by the Glacier Electric Cooperative. One 115 kV line runs into Browning from Cut Bank. The nearest commercial airport is located in Cut Bank, nearly 30 miles to the east. Air traffic generally is light.

Collection of wind data began in October 1981, when a wind-run anemometer was installed. Summaries of this data are presented in Appendix C. A data logger was installed on July 30, 1984. Data through October 29, 1985 were available for analysis. BPA currently plans to continue monitoring at the site at least through 1989. The anemometer height is 30 feet.

Data recovery was fair to excellent, ranging from 67.8 percent in December to 100.0 percent in April and June. Overall data recovery was 89.4 percent.

Average monthly wind speeds ranged from 11.2 miles per hour in July to 26.1 miles per hour in February. Average annual wind speed was 16.4 miles per hour.

Average monthly wind power ranged from 87.1 watts/m² in July up to 1,300.7 watts/m² in February.

Average seasonal wind speeds were 13.4 miles per hour in the summer, 17.3 miles per hour in the autumn, 23.9 miles per hour in the winter, and 15.2 miles per hour in the spring. In the winter, the highest wind speed occurred in mid-morning. In the spring and autumn, highest winds happened mid-morning to mid-afternoon. High winds in the summer were somewhat later, in late afternoon. Diurnal range of average wind speeds was greatest in the winter and less so in the summer and autumn. The range was smallest in the spring.

The most common wind directions were southwest to west. With the exception of winds from the east-southeast through the south, winds from other directions were minimal. By direction, average winds speeds ranged from 20.1 miles per hour from the south-southeast and west-southwest to 8.0 miles per hour from the east-northeast.

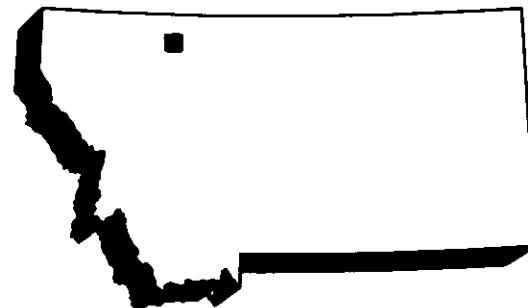


Table IV - 64

Monthly Wind Speed Distribution

GLACIER COUNTY - BLACKFOOT

07/30/84 - 10/29/85

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	CALM
0.1-1.0	0.9	0.0	1.5	0.1	0.0	0.0	0.0	0.0	0.1	0.5	0.2	0.0	0.2	0.1- 0.4
1.1-2.0	2.2	0.3	1.3	1.0	0.0	0.1	0.0	0.0	0.4	1.4	1.1	0.3	0.6	0.5- 0.9
S 2.1-3.0	1.3	0.3	2.1	1.5	0.1	0.3	0.1	0.1	0.9	1.1	2.0	2.1	0.9	1.0- 1.3
P 3.1-4.0	2.4	0.8	3.7	1.4	1.1	1.9	1.2	0.3	1.3	2.4	1.9	3.2	1.6	1.4- 1.8
E 4.1-5.0	2.4	1.1	5.9	2.2	3.9	4.0	5.0	1.9	2.7	3.7	4.1	1.9	3.2	1.9- 2.2
E 5.1-6.0	4.8	0.5	5.0	2.9	5.0	6.9	5.1	3.8	3.3	3.2	2.8	2.9	4.0	2.3- 2.7
D 6.1-7.0	6.1	0.8	5.2	3.2	6.5	6.7	8.5	5.5	2.4	4.0	3.1	2.7	4.5	2.8- 3.1
7.1-8.0	3.0	0.5	6.8	3.1	6.6	6.8	8.6	6.0	6.9	4.1	3.0	1.9	5.3	3.2- 3.6
M 8.1-9.0	3.7	0.5	5.0	2.6	9.0	9.2	11.1	7.1	6.4	4.2	3.4	1.1	5.9	3.7- 4.0
I 9.1-10.0	0.6	0.8	8.5	4.4	10.2	8.5	10.4	6.3	6.8	3.4	2.3	1.3	5.9	4.1- 4.5
L 10.1-11.0	1.5	0.8	4.9	3.9	8.3	6.8	7.6	6.1	5.3	3.0	2.3	0.8	4.8	4.6- 4.9
E 11.1-12.0	0.9	1.3	4.2	2.6	6.7	6.5	7.7	7.7	4.7	4.6	3.1	3.5	5.1	5.0- 5.4
S 12.1-13.0	1.3	2.9	4.1	2.6	6.7	6.4	7.3	6.1	4.9	4.7	3.1	1.1	4.8	5.5- 5.8
/ 13.1-14.0	1.7	4.0	3.3	4.0	3.6	4.4	6.0	6.3	4.4	4.0	3.4	2.7	4.4	5.9- 6.3
H 14.1-15.0	1.5	4.5	3.4	3.8	3.9	4.6	5.1	6.1	3.4	3.9	5.0	1.9	4.2	6.4- 6.7
O 15.1-16.0	1.9	3.7	4.9	4.9	3.5	4.2	4.5	4.9	5.1	3.1	3.9	2.7	4.2	6.8- 7.2
U 16.1-17.0	3.2	3.2	3.3	3.2	3.9	3.5	2.2	5.0	3.8	4.0	5.3	1.9	3.8	7.3- 7.6
R 17.1-18.0	3.0	3.7	4.2	3.9	3.4	3.1	3.6	4.0	3.1	3.3	4.7	1.9	3.6	7.7- 8.0
18.1-19.0	5.0	3.2	2.9	3.1	2.8	1.8	1.9	2.6	3.0	3.5	3.8	1.9	2.9	8.1- 8.5
19.1-20.0	1.7	3.2	2.4	2.9	1.9	1.8	1.4	2.4	3.0	3.7	4.1	4.5	2.7	8.6- 8.9
20.1-25.0	12.7	15.0	9.6	16.3	7.1	7.6	2.3	8.9	11.1	14.9	13.4	19.0	10.8	9.0-11.2
25.1-30.0	16.6	13.4	5.7	13.6	3.5	3.1	0.1	4.2	8.7	8.7	9.7	13.9	7.4	11.3-13.4
30.1-35.0	9.9	13.1	2.0	7.6	1.7	1.7	0.0	2.9	4.8	6.3	6.3	11.0	4.7	13.5-15.6
35.1-40.0	9.1	8.6	0.2	2.4	0.4	0.1	0.0	1.7	1.3	2.8	4.1	4.8	2.3	15.7-17.9
>40.0	6.9	13.6	0.0	2.8	0.0	0.0	0.0	0.1	2.2	1.2	3.9	11.2	2.3	>17.9
AVERAGE SPEED (MPH)	22.2	26.1	13.2	19.0	13.1	12.8	11.2	14.8	16.5	17.2	18.8	23.5	16.4	
AVERAGE SPEED (M/SEC)	9.9	11.7	5.9	8.5	5.9	5.7	5.0	6.6	7.4	7.7	8.4	10.5	7.3	
AVERAGE WIND POWER (WATTS/M**2)	966.9	1300.7	218.7	575.3	182.4	169.8	87.1	253.9	409.2	449.3	612.6	1127.5	432.3	
PERCENT DATA RECOVERY	74.2	86.6	82.7	100.0	99.9	100.0	99.6	99.9	87.5	76.7	88.9	67.8	89.4	

ANEMOMETER HEIGHT = 9 METERS = 30 FEET

NUMBER OF OBSERVATIONS = 9076

PERCENTAGE DATA RECOVERY = 89.4

SOURCE: GEORESEARCH, INC.

Table IV - 65
Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - BLACKFOOT
(WINTER)

07/30/84 - 10/29/85

	CALM	WIND SPEED (MPH)													AV SPEED (MPH)	AV SPEED (M/SEC)		
		0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1-			
	CALM	0.1-	0.9-	1.8-	2.7-	3.6-	4.5-	5.4-	6.3-	7.2-	8.1-	9.0-	11.2-	13.5-	15.7-	AV SPEED (MPH)	AV SPEED (M/SEC)	
		0.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.0	8.9	11.2	13.4	15.6	17.9			
	1	0.0	0.0	5.0	2.5	5.0	7.5	2.5	0.0	5.0	12.5	2.5	12.5	20.0	10.0	5.0	10.0	23.6 10.5
	2	0.0	5.0	2.5	5.0	2.5	0.0	2.5	5.0	5.0	7.5	7.5	10.0	25.0	15.0	0.0	7.5	22.9 10.2
	3	0.0	2.5	2.5	5.0	2.5	5.0	2.5	7.5	5.0	7.5	2.5	12.5	15.0	25.0	5.0	0.0	22.3 10.0
	4	0.0	2.5	2.5	5.0	2.5	5.0	2.5	7.5	2.5	2.5	10.0	17.5	7.5	20.0	2.5	10.0	22.9 10.2
	5	0.0	0.0	5.0	7.5	0.0	2.5	0.0	7.5	5.0	7.5	5.0	20.0	12.5	20.0	2.5	5.0	23.0 10.3
	6	0.0	0.0	5.0	7.5	2.5	0.0	2.5	10.0	2.5	2.5	10.0	27.5	12.5	7.5	5.0	5.0	22.2 9.9
	7	0.0	0.0	0.0	12.1	0.0	0.0	0.0	6.1	9.1	3.0	0.0	30.3	9.1	18.2	9.1	3.0	24.2 10.8
	8	0.0	0.0	0.0	6.5	0.0	3.2	0.0	0.0	9.7	6.5	6.5	9.7	29.0	12.9	12.9	3.2	25.5 11.4
H	9	0.0	3.2	0.0	0.0	0.0	3.2	3.2	3.2	3.2	6.5	6.5	16.1	19.4	12.9	12.9	9.7	27.2 12.1
O	10	0.0	0.0	3.2	0.0	3.2	0.0	3.2	0.0	3.2	12.9	12.9	19.4	9.7	16.1	12.9	27.7	12.4
O	11	0.0	0.0	3.2	0.0	6.5	0.0	3.2	0.0	0.0	16.1	16.1	16.1	9.7	12.9	16.1	27.6	12.3
	12	0.0	0.0	0.0	3.2	0.0	6.5	0.0	9.7	0.0	0.0	0.0	25.8	9.7	9.7	16.1	19.4	29.6 13.2
U	13	0.0	2.3	4.7	4.7	2.3	2.3	0.0	4.7	7.0	4.7	2.3	18.6	14.0	9.3	4.7	18.6	25.6 11.4
	14	0.0	2.3	2.3	7.0	0.0	0.0	4.7	4.7	7.0	2.3	9.3	23.3	7.0	9.3	7.0	14.0	24.5 11.0
R	15	0.0	2.9	0.0	0.0	11.8	0.0	0.0	2.9	0.0	17.6	5.9	11.8	8.8	17.6	11.8	8.8	24.7 11.0
	16	0.0	2.9	2.9	2.9	2.9	5.9	5.9	0.0	5.9	11.8	2.9	17.6	8.8	14.7	5.9	8.8	22.9 10.3
	17	0.0	2.9	2.9	0.0	11.8	2.9	2.9	5.9	11.8	0.0	5.9	11.8	8.8	11.8	14.7	5.9	22.9 10.2
	18	0.0	5.9	2.9	2.9	5.9	2.9	2.9	11.8	2.9	2.9	17.6	5.9	17.6	8.8	5.9	22.2 9.9	
	19	0.0	2.9	0.0	5.9	8.8	5.9	5.9	2.9	2.9	8.8	2.9	20.6	5.9	11.8	8.8	5.9	21.3 9.5
	20	0.0	2.9	0.0	5.9	2.9	8.8	2.9	0.0	11.8	11.8	8.8	14.7	2.9	11.8	5.9	8.8	21.5 9.6
	21	0.0	3.0	3.0	12.1	0.0	0.0	0.0	15.2	12.1	3.0	6.1	12.1	9.1	9.1	6.1	21.1	9.4
	22	0.0	0.0	6.1	6.1	0.0	3.0	3.0	6.1	12.1	12.1	6.1	6.1	21.2	3.0	9.1	22.5 10.1	
	23	0.0	0.0	3.7	0.0	7.4	0.0	3.7	7.4	0.0	11.1	18.5	7.4	14.8	3.7	11.1	11.1	24.1 10.8
	24	0.0	0.0	0.0	7.7	0.0	7.7	0.0	0.0	3.8	15.4	11.5	15.4	15.4	11.5	3.8	7.7	24.2 10.8
	ALL HOURS	0.0	1.8	2.5	4.7	3.2	3.0	2.3	4.8	5.6	6.6	6.6	16.4	12.5	13.5	7.8	8.8	23.9 10.7

SOURCE: GEORESEARCH, INC.

Table IV - 66

Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - BLACKFOOT
(SPRING)

07/30/84 - 10/29/85

		WIND SPEED (MPH)																	
		CALM	0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1-	>40.0		
		CALM	0.1-	0.9-	1.8-	2.7-	3.6-	4.5-	5.4-	6.3-	7.2-	8.1-	9.0-	11.2-	13.5-	15.7-	>17.9	SPEED (MPH)	SPEED (M/SEC)
H	1	0.0	2.2	3.3	13.2	17.6	13.2	6.6	13.2	6.6	6.6	1.1	7.7	4.4	4.4	0.0	0.0	12.8	5.7
	2	0.0	1.1	5.5	14.3	11.0	17.6	7.7	5.5	12.1	6.6	2.2	11.0	3.3	1.1	0.0	1.1	13.1	5.8
	3	0.0	2.2	4.4	9.9	12.1	13.2	14.3	8.8	6.6	6.6	3.3	9.9	4.4	3.3	0.0	1.1	13.6	6.1
	4	0.0	2.2	6.6	8.8	12.1	15.4	13.2	6.6	9.9	1.1	5.5	12.1	2.2	3.3	0.0	1.1	13.4	6.0
	5	0.0	3.3	5.5	11.0	16.5	14.3	9.9	6.6	8.8	4.4	3.3	8.8	4.4	2.2	0.0	1.1	12.7	5.7
	6	0.0	3.3	7.7	12.1	7.7	15.4	9.9	9.9	2.2	6.6	6.6	9.9	3.3	4.4	1.1	0.0	13.5	6.0
	7	0.0	1.2	6.0	10.7	10.7	16.7	13.1	8.3	6.0	3.6	3.6	8.3	6.0	3.6	1.2	1.2	13.8	6.2
	8	0.0	1.2	4.8	10.7	10.7	13.1	8.3	7.1	9.5	3.6	8.3	7.1	4.8	6.0	2.4	2.4	15.4	6.9
	9	0.0	2.4	1.2	8.3	15.5	9.5	7.1	6.0	2.4	4.8	3.6	20.2	6.0	7.1	4.8	1.2	17.2	7.7
	10	0.0	2.4	2.4	2.4	11.9	13.1	9.5	4.8	7.1	6.0	3.6	16.7	8.3	6.0	3.6	2.4	17.7	7.9
	11	0.0	1.2	1.2	9.5	3.6	13.1	8.3	6.0	11.9	3.6	4.8	15.5	9.5	9.5	0.0	2.4	17.8	8.0
	12	0.0	1.2	0.0	4.8	9.5	11.9	6.0	7.1	3.6	9.5	8.3	17.9	10.7	7.1	1.2	1.2	18.1	8.1
	13	0.0	0.0	3.3	4.3	7.6	7.6	6.5	6.5	5.4	16.3	5.4	19.6	8.7	6.5	2.2	0.0	17.9	8.0
	14	0.0	0.0	3.3	7.6	5.4	6.5	5.4	8.7	7.6	14.1	3.3	22.8	6.5	6.5	1.1	1.1	18.0	8.1
	15	0.0	0.0	2.4	4.7	7.1	4.7	10.6	8.2	7.1	9.4	9.4	18.8	10.6	5.9	0.0	1.2	17.9	8.0
	16	0.0	0.0	1.2	2.4	5.9	8.2	9.4	8.2	10.6	14.1	3.5	21.2	10.6	3.5	1.2	0.0	17.9	8.0
	17	0.0	0.0	1.2	4.7	5.9	4.7	12.9	8.2	10.6	5.9	12.9	18.8	7.1	5.9	1.2	0.0	17.8	7.9
	18	0.0	1.2	0.0	4.7	5.9	9.4	10.6	9.4	14.1	11.8	8.2	15.3	5.9	2.4	1.2	0.0	16.4	7.3
	19	0.0	0.0	1.2	3.5	8.2	16.5	14.1	14.1	8.2	8.2	9.4	11.8	2.4	2.4	0.0	0.0	14.6	6.5
	20	0.0	0.0	2.4	7.1	12.9	22.4	14.1	8.2	9.4	5.9	5.9	8.2	2.4	1.2	0.0	0.0	13.0	5.8
	21	0.0	1.2	2.4	9.4	12.9	16.5	12.9	12.9	5.9	9.4	5.9	5.9	3.5	1.2	0.0	0.0	12.9	5.8
	22	0.0	2.4	2.4	7.1	11.8	18.8	17.6	9.4	10.6	3.5	3.5	8.2	3.5	1.2	0.0	0.0	12.7	5.7
	23	0.0	0.0	2.4	12.0	15.7	21.7	7.2	6.0	10.8	6.0	2.4	9.6	2.4	2.4	1.2	0.0	13.1	5.9
	24	0.0	0.0	4.9	12.3	11.1	17.3	13.6	6.2	7.4	6.2	4.9	9.9	2.5	3.7	0.0	0.0	13.3	5.9
ALL HOURS		0.0	1.2	3.2	8.2	10.4	13.3	10.3	8.2	8.1	7.3	5.3	13.1	5.5	4.2	0.9	0.7	15.2	6.8

SOURCE: GEORESEARCH, INC.

Table IV - 67
Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - BLACKFOOT
(SUMMER)

07/30/84 - 10/29/85

		WIND SPEED (MPH)																			
		CALM	0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1-	>40.0	AV	AV		
		CALM	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0	30.0	35.0	40.0	>40.0	SPEED	SPEED		
		CALM	0.1-	0.9-	1.8-	2.7-	3.6-	4.5-	5.4-	6.3-	7.2-	8.1-	9.0-	11.2-	13.5-	15.7-	>17.9	(MPH)	(M/SEC)		
		1	0.0	0.0	2.4	12.1	19.4	21.8	13.7	11.3	8.1	3.2	1.6	3.2	0.0	2.4	0.8	0.0	11.2	5.0	
		2	0.0	0.0	2.4	14.5	21.0	21.8	15.3	10.5	5.6	3.2	1.6	2.4	0.0	0.8	0.0	0.8	10.6	4.8	
		3	0.0	0.0	4.0	17.7	18.5	17.7	17.7	6.5	8.1	4.0	0.8	2.4	0.8	1.6	0.0	0.0	10.6	4.7	
		4	0.0	0.0	3.2	12.1	24.2	17.7	16.1	9.7	6.5	4.8	1.6	2.4	0.8	0.8	0.0	0.0	10.7	4.8	
		5	0.0	0.0	4.0	18.5	18.5	16.1	13.7	12.9	7.3	4.0	0.8	2.4	0.8	0.0	0.8	0.0	10.4	4.7	
		6	0.0	0.0	3.2	19.4	20.2	17.7	12.1	8.1	10.5	0.8	1.6	5.6	0.0	0.8	0.0	0.0	10.5	4.7	
		7	0.0	0.8	1.6	18.5	15.3	16.1	13.7	13.7	7.3	4.8	0.0	3.2	3.2	0.8	0.8	0.0	11.4	5.1	
		8	0.0	0.0	0.0	12.9	16.1	16.1	14.5	8.9	13.7	3.2	4.0	4.0	5.6	0.0	0.8	0.0	12.7	5.7	
	H	9	0.0	0.0	0.8	8.1	13.7	13.7	17.7	10.5	9.7	7.3	3.2	8.1	4.0	3.2	0.0	0.0	13.7	6.1	
	O	10	0.0	0.0	0.0	8.1	11.3	13.7	11.3	20.2	8.1	6.5	4.0	8.9	2.4	5.6	0.0	0.0	14.5	6.5	
	O	11	0.0	0.0	0.0	4.0	11.3	12.9	16.1	14.5	8.9	9.7	4.0	7.3	4.0	6.5	0.8	0.0	15.3	6.8	
	U	12	0.0	0.0	0.0	0.8	11.3	12.9	12.1	13.7	14.5	8.9	6.5	8.9	3.2	6.5	0.8	0.0	15.8	7.1	
	R	13	0.0	0.0	0.0	1.6	9.6	13.6	8.8	12.8	19.2	7.2	6.4	12.0	4.0	4.0	0.8	0.0	16.0	7.2	
	R	14	0.0	0.0	0.0	1.6	8.0	8.8	21.6	7.2	12.0	12.8	7.2	12.8	3.2	4.8	0.0	0.0	16.0	7.2	
	R	15	0.0	0.0	0.0	1.6	7.2	8.8	11.2	12.0	12.0	16.0	6.4	14.4	4.0	6.4	0.0	0.0	16.7	7.5	
	R	16	0.0	0.0	0.0	0.8	5.6	12.0	6.4	12.8	8.0	17.6	4.0	22.4	7.2	2.4	0.8	0.0	17.4	7.8	
	R	17	0.0	0.0	0.0	1.6	5.6	12.0	6.4	14.4	9.6	13.6	12.0	16.8	5.6	1.6	0.8	0.0	16.9	7.5	
	R	18	0.0	0.0	1.6	0.8	6.4	12.8	9.6	16.8	12.0	12.0	10.4	3.2	0.8	1.6	0.0	0.0	15.6	7.0	
	R	19	0.0	0.0	0.0	4.8	4.0	14.4	21.6	14.4	10.4	12.0	7.2	9.6	0.0	1.6	0.0	0.0	14.2	6.4	
	R	20	0.0	0.0	0.0	3.2	10.4	17.6	20.0	14.4	13.6	10.4	2.4	4.0	2.4	0.8	0.8	0.0	0.0	13.4	6.0
	R	21	0.0	0.0	0.8	2.4	14.4	22.4	12.8	20.0	10.4	4.8	5.6	4.0	0.8	1.6	0.0	0.0	12.8	5.7	
	R	22	0.0	0.0	0.0	8.1	14.5	21.0	20.2	12.1	8.9	8.1	1.6	3.2	1.6	0.0	0.8	0.0	12.0	5.4	
	R	23	0.0	0.0	0.8	10.6	17.9	25.2	13.0	11.4	8.9	3.3	4.1	3.3	0.8	0.8	0.0	0.0	11.3	5.1	
	R	24	0.0	0.0	0.8	12.2	17.9	29.3	12.2	5.7	8.9	4.1	2.4	4.1	0.0	2.4	0.0	0.0	11.2	5.0	
	ALL HOURS		0.0	0.0	1.1	8.1	13.4	16.5	14.1	12.3	10.1	7.6	4.2	7.3	2.4	2.3	0.4	0.0	13.4	6.0	

SOURCE: GEORESEARCH, INC.

Table IV - 68
Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - BLACKFOOT
(AUTUMN)

07/30/84 - 10/29/85

		WIND SPEED (MPH)																	
		CALM	0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1-	>40.0	AV	AV
		CALM	0.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.0	8.9	11.2	13.4	15.6	17.9	>17.9	SPEED	SPEED
			(MPH)	(M/S)													(MPH)(M/SEC)		
H	1	0.0	1.5	5.2	8.9	5.9	13.3	8.9	10.4	7.4	8.1	5.9	13.3	4.4	3.7	1.5	1.5	15.5	6.9
	2	0.0	1.5	5.2	9.0	10.4	6.7	11.2	9.7	3.0	11.2	7.5	13.4	3.0	2.2	2.2	3.7	15.7	7.0
	3	0.0	0.0	6.1	6.8	13.6	8.3	9.1	8.3	10.6	7.6	5.3	12.1	4.5	2.3	1.5	3.8	15.7	7.0
	4	0.0	0.8	5.3	7.6	13.7	6.9	6.9	10.7	8.4	10.7	4.6	11.5	4.6	3.1	3.8	1.5	15.8	7.1
	5	0.0	0.8	4.7	7.9	9.4	7.9	11.8	11.0	10.2	4.7	9.4	7.1	3.9	7.9	1.6	1.6	16.0	7.2
	6	0.0	2.4	3.2	5.6	12.0	12.0	10.4	8.0	8.0	6.4	8.0	12.8	1.6	4.0	1.6	4.0	15.9	7.1
	7	0.0	1.7	5.1	7.7	10.3	5.1	14.5	6.0	6.8	6.8	11.1	12.0	3.4	4.3	1.7	3.4	16.4	7.3
	8	0.0	1.7	6.9	7.8	6.0	14.7	5.2	5.2	6.9	6.0	5.2	17.2	6.0	6.0	3.4	1.7	16.8	7.5
	9	0.0	1.7	2.6	9.5	8.6	8.6	3.4	6.0	2.6	7.8	8.6	16.4	11.2	8.6	2.6	1.7	18.4	8.2
	10	0.0	2.7	1.8	8.1	6.3	11.7	4.5	3.6	5.4	2.7	5.4	20.7	12.6	8.1	1.8	4.5	19.3	8.6
	11	0.0	0.0	2.8	3.7	5.6	12.0	6.5	6.5	5.6	1.9	11.1	16.7	10.2	11.1	3.7	2.8	20.3	9.1
	12	0.0	1.0	1.0	1.0	3.9	13.6	8.7	6.8	8.7	5.8	2.9	16.5	12.6	11.7	3.9	1.9	20.3	9.1
	13	0.0	1.5	0.0	3.7	6.0	9.0	7.5	7.5	12.7	4.5	3.0	16.4	7.5	15.7	3.7	1.5	19.9	8.9
	14	0.0	1.5	0.7	3.7	6.7	6.7	9.7	6.0	8.2	6.0	7.5	16.4	11.2	9.7	3.7	2.2	19.9	8.9
	15	0.0	1.7	1.7	2.6	7.8	8.6	3.4	5.2	9.5	6.0	5.2	23.3	14.7	6.0	1.7	2.6	19.7	8.8
	16	0.0	0.0	0.0	6.3	10.7	6.3	4.5	4.5	8.0	14.3	8.9	15.2	9.8	8.0	2.7	0.9	19.0	8.5
	17	0.0	0.9	1.8	7.1	6.3	7.1	3.6	10.7	9.8	11.6	8.9	17.0	7.1	5.4	1.8	0.9	17.8	8.0
	18	0.0	0.9	5.4	3.6	6.3	7.2	9.0	9.9	12.6	7.2	5.4	18.9	8.1	3.6	0.0	1.8	16.7	7.5
	19	0.0	1.8	2.7	6.4	1.8	7.3	10.9	14.5	10.9	8.2	7.3	16.4	7.3	2.7	1.8	0.0	16.6	7.4
	20	0.0	2.7	1.8	5.5	5.5	13.6	5.5	14.5	5.5	10.9	3.6	19.1	5.5	4.5	1.8	0.0	16.2	7.2
	21	0.0	0.0	0.0	8.2	7.3	12.7	8.2	12.7	5.5	14.5	8.2	13.6	1.8	4.5	2.7	0.0	16.0	7.2
	22	0.0	0.0	0.9	9.3	10.3	11.2	10.3	9.3	11.2	6.5	6.5	16.8	1.9	4.7	0.0	0.9	15.4	6.9
	23	0.0	0.0	3.0	9.0	12.0	10.0	10.0	8.0	10.0	7.0	10.0	10.0	4.0	5.0	1.0	1.0	15.3	6.8
	24	0.0	1.1	4.3	6.5	8.6	11.8	9.7	8.6	6.5	10.8	5.4	12.9	5.4	4.3	2.2	2.2	16.0	7.2
ALL HOURS		0.0	1.2	3.1	6.5	8.2	9.6	8.1	8.5	8.1	7.8	6.8	15.2	6.7	6.1	2.2	2.0	17.3	7.7

SOURCE: GEORESEARCH, INC.

Table IV - 69

Annual Wind Rose Distribution

GLACIER COUNTY - BLACKFOOT

07/30/84 - 10/29/85

DIRECTIONS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	<DIRECTION
SPEED (MPH)																		SPEED (M/SEC)
0.1- 1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1- 0.4
1.1- 2.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.7	0.5- 0.9
2.1- 3.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.0	1.0	1.0- 1.3 S
3.1- 4.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.0	0.2	0.2	0.2	0.1	0.1	0.1	1.9	1.4- 1.8 P
S 4.1- 5.0	0.2	0.1	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.5	0.3	0.3	0.2	3.8	1.9- 2.2 E
P 5.1- 6.0	0.3	0.2	0.1	0.1	0.3	0.2	0.2	0.4	0.3	0.3	0.3	0.5	0.8	0.2	0.3	0.2	4.7	2.3- 2.7 E
E 6.1- 7.0	0.3	0.1	0.1	0.2	0.3	0.2	0.3	0.3	0.5	0.2	0.6	0.5	0.9	0.3	0.3	0.1	5.3	2.8- 3.1 D
E 7.1- 8.0	0.3	0.2	0.2	0.2	0.3	0.4	0.2	0.2	0.3	0.2	0.3	0.8	0.7	0.2	0.2	0.3	4.9	3.2- 3.6
D 8.1- 9.0	0.4	0.2	0.2	0.1	0.5	0.5	0.3	0.4	0.3	0.1	0.4	1.2	0.9	0.1	0.2	0.2	6.0	3.7- 4.0 M
9.1-10.0	0.3	0.1	0.1	0.1	0.3	0.5	0.4	0.3	0.3	0.2	0.5	1.3	1.0	0.1	0.2	0.3	6.0	4.1- 4.5 E
M 10.1-11.0	0.3	0.1	0.0	0.1	0.2	0.4	0.4	0.3	0.2	0.2	0.3	1.1	0.6	0.2	0.2	0.3	4.8	4.6- 4.9 T
I 11.1-12.0	0.2	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.3	0.2	0.4	0.9	0.6	0.1	0.2	0.3	4.8	5.0- 5.4 E
L 12.1-13.0	0.2	0.0	0.1	0.0	0.3	0.3	0.3	0.4	0.2	0.1	0.5	1.1	0.6	0.1	0.1	0.3	4.6	5.5- 5.8 R
E 13.1-14.0	0.2	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.2	0.2	0.4	1.0	0.7	0.1	0.2	0.2	4.0	5.9- 6.3 S
S 14.1-15.0	0.2	0.1	0.0	0.0	0.1	0.2	0.2	0.4	0.3	0.1	0.5	1.1	0.5	0.1	0.1	0.1	3.9	6.4- 6.7 /
/ 15.1-16.0	0.3	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.2	0.2	0.4	1.1	0.5	0.1	0.1	0.1	3.7	6.8- 7.2 S
H 16.1-17.0	0.2	0.0	0.0	0.0	0.0	0.3	0.2	0.4	0.2	0.1	0.5	0.8	0.5	0.0	0.1	0.2	3.4	7.3- 7.6 E
O 17.1-18.0	0.1	0.0	0.1	0.0	0.0	0.1	0.2	0.3	0.1	0.1	0.6	1.1	0.5	0.1	0.1	0.2	3.4	7.7- 8.0 C
U 18.1-19.0	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.3	0.1	0.1	0.5	0.8	0.5	0.0	0.0	0.1	2.8	8.1- 8.5 O
R 19.1-20.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.2	0.1	0.4	0.8	0.3	0.0	0.0	0.1	2.5	8.6- 8.9 N
20.1-25.0	0.3	0.0	0.0	0.0	0.1	0.2	0.7	1.3	0.5	0.3	1.8	3.8	1.2	0.0	0.1	0.3	10.7	9.0-11.2 D
25.1-30.0	0.1	0.0	0.0	0.0	0.0	0.1	0.6	0.9	0.3	0.2	1.4	2.7	0.9	0.0	0.0	0.1	7.4	11.3-13.4
30.1-35.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.6	0.2	0.1	0.6	2.1	0.5	0.0	0.0	0.0	4.7	13.5-15.6
35.1-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.1	0.0	0.1	1.4	0.2	0.0	0.0	0.0	2.7	15.7-17.9
>40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1	0.0	0.1	0.9	0.2	0.0	0.0	0.0	2.1	>17.9
CALM																		0.0 CALM
TOTAL AV SPEED (MPH)	4.1	1.6	1.3	1.1	3.2	4.7	6.4	9.6	5.8	3.3	11.1	25.3	13.5	2.4	2.8	3.9	100.0	TOTAL AV SPEED (MPH)
AV SPEED (M/SEC)	11.6	9.4	9.8	8.0	9.1	12.7	17.8	20.1	14.0	13.3	17.9	20.1	15.2	9.6	9.8	12.3	16.1	AV SPEED (M/SEC)

SOURCE: GEORESEARCH, INC.

Figure IV - 7
Annual Wind Rose
GLACIER COUNTY - BLACKFOOT
(1984 - 1985)

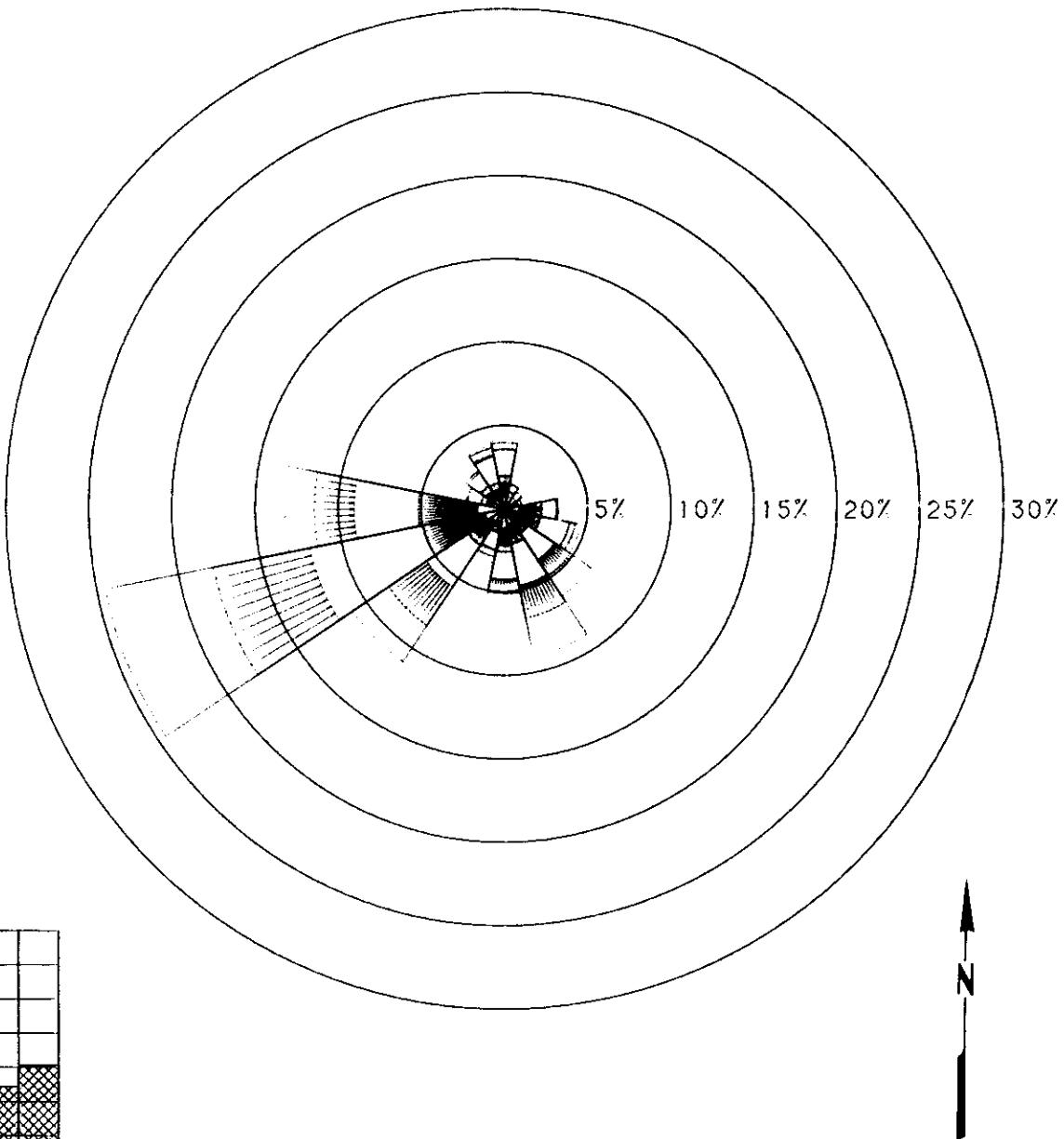
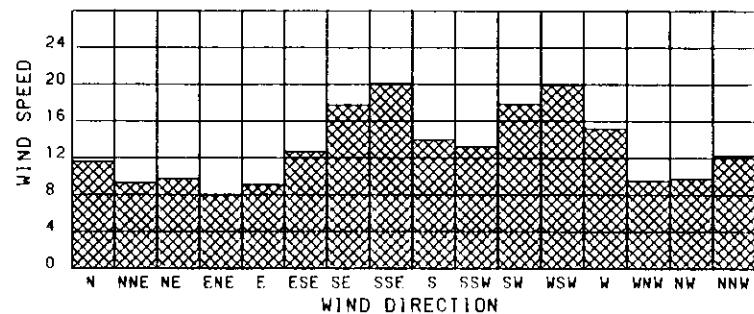
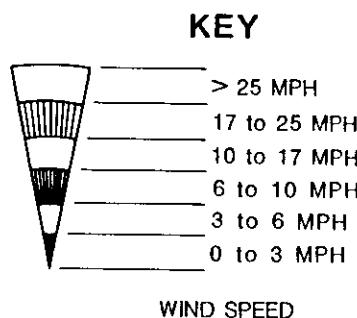


Table IV - 70
Coefficients of Weibull Distribution
GLACIER COUNTY - BLACKFOOT

07/30/84 - 10/29/85

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	12.3355	1.6922
FEBRUARY	13.0648	2.3182
MARCH	6.2717	1.7252
APRIL	9.6212	1.9089
MAY	5.5429	2.4051
JUNE	5.5284	2.2757
JULY	5.1009	2.7248
AUGUST	6.3942	2.4234
SEPTEMBER	7.4238	1.9164
OCTOBER	8.5875	1.7505
NOVEMBER	9.2984	1.8151
DECEMBER	12.4529	1.8769
YEAR	7.3608	1.8587

SOURCE: GEORESEARCH, INC.

CUT BANK

GLACIER COUNTY

The Cut Bank site is located in a gently rolling area about 12 miles north of Cut Bank at 48° 47' 54" N and 112° 19' 37" W (Site No. 55 on Map II-1). Elevation at the site is 4,120 feet. This site was established by the Bureau of Reclamation as part of its Northern Great Plains Wind Energy Study. The Department of Natural Resources and Conservation assumed responsibility for the monitoring site in October 1982.

The site is on the Great Plains about 40 miles east of the Rocky Mountain Front and about 50 miles west of the Sweetgrass Hills. The land in the area is used predominantly for agriculture. While most of the land is privately owned, there are a few sections of state and federal land. The Blackfeet Indian Reservation lies a few miles to the west. Interstate Highway 15 runs near the site, and many county roads cross the area.

Electrical service in the Cut Bank area is provided by Glacier County Electric Cooperative. A 115-kV transmission line runs east-west through Cut Bank. The nearest commercial airport is at Cut Bank, approximately 15 miles to the south. Air traffic in the area generally is light.

Collection of wind data began on June 3, 1981, and continued through August 3, 1983. Data from the wind sensors were continuously recorded on cassette tape at the site. These tapes were further processed by computer to yield hourly averages of wind speed, wind direction, the average cube of the hourly speed, and standard deviation of the hourly speed. In addition, the maximum and minimum instantaneous values of wind speed during each hour were recorded. Anemometer height was 10 meters. A bushy wind break, house, and ranch buildings within 100 yards to the east and south of the site, as well as a bent and unbalanced wind vane shaft, make the wind direction data highly questionable.

Data recovery was fair to excellent, ranging from 43.3 percent in September to 100.0 percent in April. Overall data recovery for the period was 82.4 percent.

Average monthly wind speeds at this site ranged from 10.5 miles per hour in August to 14.8 miles per hour in May. Average annual wind speed was 12.8 miles per hour.

Average monthly wind power ranged from 96.2 watts/m² in August to 306.3 watts/m² in January. Average annual wind power was 217.1 watts/m².

Average seasonal wind speeds were 12.2 miles per hour in summer, 12.3 miles per hour in autumn, 13.2 miles per hour in winter, and 13.5 miles per hour in spring. In winter, the highest average wind speeds occurred in mid-afternoon. In spring and autumn, the highest average wind speeds occurred in late afternoon, and in summer they occurred in early evening. The lowest average wind speeds occurred around 0500 to 0800 MST year round. The diurnal range of average wind speeds was greatest in summer and least in winter.

The most common wind directions were west, west-northwest, and south. Winds from the east and east-southeast were least common. By direction, average wind speeds ranged from 8.6 miles per hour for southwest winds to 15.8 miles per hour for westerly winds.

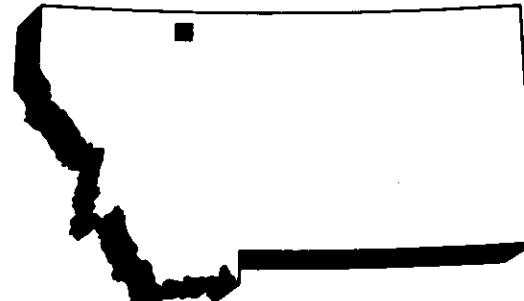


Table IV - 71

Monthly Wind Speed Distribution

GLACIER COUNTY - CUT BANK

06/03/81 - 08/03/83

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
CALM	0.4	2.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.5
0.1-1.0	0.9	2.8	1.2	0.2	0.0	0.1	0.1	0.3	0.2	0.2	0.4	0.7	0.6
1.1-2.0	2.8	3.9	2.6	0.7	0.2	0.6	0.2	1.9	0.6	0.8	1.1	2.5	1.5
S 2.1-3.0	3.9	2.6	2.7	1.5	0.6	1.5	1.0	2.5	2.2	2.4	1.7	2.4	2.1
P 3.1-4.0	5.5	3.6	3.1	4.3	2.0	2.7	3.2	5.8	5.4	4.9	3.3	3.5	3.8
E 4.1-5.0	6.3	3.6	3.8	3.4	2.2	3.4	4.0	5.8	5.4	5.3	4.4	4.0	4.2
E 5.1-6.0	6.4	5.6	4.7	5.7	4.8	6.5	6.7	7.7	5.0	6.5	4.8	6.5	6.0
D 6.1-7.0	3.4	3.9	4.3	5.9	3.7	5.3	7.1	6.8	6.4	5.0	5.7	5.8	5.2
7.1-8.0	4.7	4.5	6.4	6.5	6.5	7.7	7.5	9.6	5.4	7.0	7.9	6.3	6.7
M 8.1-9.0	3.8	4.3	4.1	6.3	4.8	5.5	6.6	6.5	5.1	4.9	6.7	4.0	5.2
I 9.1-10.0	5.2	6.7	6.5	6.4	5.9	6.5	7.7	8.0	6.3	6.0	7.8	6.9	6.7
L 10.1-11.0	4.0	3.8	5.1	5.2	4.8	4.9	5.8	3.9	5.0	4.8	4.7	4.4	4.7
E 11.1-12.0	5.4	5.1	6.5	6.9	6.5	6.6	6.4	6.3	6.6	7.0	6.5	7.5	6.4
S 12.1-13.0	4.0	4.3	6.5	5.5	4.7	4.4	5.9	4.5	6.6	4.5	3.8	4.3	4.8
/ 13.1-14.0	3.6	3.9	6.1	5.2	5.9	5.7	5.7	4.5	5.9	5.1	4.9	5.0	5.1
H 14.1-15.0	3.2	3.9	4.6	4.2	4.8	4.2	4.4	4.2	4.3	3.9	4.5	3.1	4.1
O 15.1-16.0	3.3	2.8	4.8	2.4	4.7	4.4	3.4	2.9	4.0	3.9	3.2	3.5	3.6
U 16.1-17.0	3.6	3.6	4.9	3.5	5.7	5.4	2.6	4.8	4.5	3.9	4.6	3.7	4.2
R 17.1-18.0	2.6	3.0	3.2	2.3	3.3	3.5	2.6	2.6	2.9	4.1	2.7	2.4	2.9
18.1-19.0	3.6	3.0	3.6	3.3	3.8	3.4	3.3	2.6	3.0	3.3	3.6	3.1	3.3
19.1-20.0	1.8	1.5	2.6	2.2	3.0	2.9	2.1	1.7	1.4	2.2	2.0	1.6	2.1
20.1-25.0	8.5	10.3	8.5	8.3	12.4	8.5	8.3	6.3	9.3	7.9	8.3	8.5	8.7
25.1-30.0	7.2	5.3	2.8	6.2	5.7	4.2	2.8	0.7	2.6	4.1	3.4	4.7	4.3
30.1-35.0	3.4	2.9	0.7	2.3	2.8	1.8	1.5	0.0	1.3	2.0	0.9	3.0	2.0
35.1-40.0	1.1	1.6	0.2	1.0	1.2	0.2	0.4	0.0	0.5	0.2	0.2	1.4	0.7
>40.0	1.3	0.5	0.3	0.8	0.1	0.1	0.8	0.0	0.0	0.0	0.1	1.2	0.5
AVERAGE SPEED (MPH)	13.4	12.9	12.4	13.5	14.8	13.1	12.6	10.5	12.3	12.5	12.0	13.3	12.8
AVERAGE SPEED (M/SEC)	6.0	5.8	5.6	6.0	6.6	5.8	5.6	4.7	5.5	5.6	5.4	6.0	5.7
AVERAGE WIND POWER (WATTS/M**2)	306.3	271.8	176.5	255.0	264.9	188.5	184.2	96.2	165.7	183.3	167.3	291.3	217.1
PERCENT DATA RECOVERY	99.6	98.3	91.4	100.0	79.1	78.4	64.6	71.4	43.3	80.1	95.7	99.9	82.4

ANEMOMETER HEIGHT = 10 METERS = 33 FEET

NUMBER OF OBSERVATIONS = 15672

PERCENTAGE DATA RECOVERY = 82.4

SOURCE: GEORESEARCH, INC.

Table IV - 72

Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - CUT BANK (WINTER)

06/03/81 - 08/03/83

		WIND SPEED (MPH)															AV (MPH)	AV (M/SEC)		
		CALM	0.1-2.0	2.1-4.0	4.1-6.0	6.1-8.0	8.1-10.0	10.1-12.0	12.1-14.0	14.1-16.0	16.1-18.0	18.1-20.0	20.1-25.0	25.1-30.0	30.1-35.0	35.1->40.0				
		CALM	0.1-0.9	0.9-1.8	1.8-2.7	2.7-3.6	3.6-4.5	4.5-5.4	5.4-6.3	6.3-7.2	7.2-8.0	8.1-8.9	9.0-11.2	11.2-13.4	13.5-15.6	15.7-17.9	>17.9			
		1	1.1	4.4	10.0	8.3	7.8	13.9	8.3	6.1	8.3	7.2	6.7	10.6	2.2	2.8	0.6	1.7	13.0	5.8
		2	1.1	2.8	11.1	7.8	16.1	6.1	7.2	11.1	7.2	5.6	4.4	11.1	2.8	3.3	1.1	1.1	12.9	5.7
		3	1.7	4.4	8.9	12.2	6.7	14.4	12.2	6.7	5.0	5.6	6.7	9.4	3.3	1.7	0.0	1.1	12.1	5.4
		4	1.1	5.6	6.7	17.8	9.4	9.4	10.0	10.6	7.8	4.4	2.8	5.0	5.6	2.8	0.0	1.1	11.8	5.3
		5	1.1	5.6	7.2	13.3	12.8	11.1	10.6	11.7	6.1	3.3	1.7	8.3	3.3	2.2	0.6	1.1	11.7	5.3
		6	0.6	5.0	8.9	14.4	12.2	8.9	10.6	7.8	8.9	6.7	2.8	7.2	2.2	2.2	1.1	0.6	11.7	5.2
		7	0.6	3.4	10.1	11.7	10.1	14.5	13.4	7.8	6.1	7.3	3.4	6.1	1.7	1.7	0.6	11.5	5.1	
		8	0.6	5.1	7.9	15.2	11.8	11.2	12.9	8.4	3.4	7.9	3.9	4.5	3.4	2.8	0.6	0.6	11.5	5.1
H		9	1.1	5.6	10.7	11.2	7.9	17.4	8.4	7.3	2.8	7.9	3.9	7.3	3.9	3.9	0.0	0.6	11.8	5.3
O		10	1.7	5.1	7.9	16.9	9.6	9.6	9.6	6.8	5.6	3.4	6.2	7.9	3.4	5.6	0.6	0.0	12.2	5.5
O		11	2.3	6.2	7.3	9.6	14.7	10.2	10.7	4.5	4.5	4.5	4.0	10.2	4.5	5.1	1.7	0.0	12.7	5.7
		12	1.7	5.1	12.5	10.8	9.7	11.4	5.7	6.8	3.4	4.5	6.3	10.2	5.7	4.5	1.1	0.6	12.8	5.7
U		13	1.1	5.0	7.8	15.1	7.3	7.3	8.4	6.7	5.6	5.0	4.5	12.3	8.4	3.9	1.1	0.6	13.7	6.1
R		14	2.2	2.8	5.0	15.6	6.7	6.1	6.7	7.8	7.3	5.0	5.6	11.2	7.3	8.4	0.6	1.7	15.1	6.7
R		15	1.7	3.4	5.6	10.1	6.1	6.1	12.3	3.9	6.7	6.1	3.4	14.5	8.9	7.8	1.1	2.2	16.1	7.2
		16	1.1	6.1	2.8	7.8	8.9	4.5	9.5	5.6	5.6	6.7	5.0	21.2	4.5	6.1	2.8	1.7	16.4	7.3
		17	0.6	3.9	4.5	7.8	6.7	9.5	7.3	7.3	6.1	5.6	7.8	18.4	7.8	3.9	1.7	1.1	15.8	7.1
		18	0.6	1.7	5.0	8.4	8.9	8.4	10.6	8.4	6.1	7.3	6.7	15.1	6.1	5.0	1.1	0.6	15.1	6.8
		19	0.6	3.4	4.5	4.5	7.8	15.6	11.2	10.1	10.6	6.7	5.0	10.6	3.9	3.9	1.7	0.0	14.1	6.3
		20	0.6	3.4	3.9	6.1	10.6	10.1	12.3	12.8	9.5	8.9	5.0	8.9	3.4	1.7	2.2	0.6	13.8	6.2
		21	0.0	4.5	5.6	6.1	10.1	12.3	11.2	13.4	7.8	5.6	7.3	9.5	2.8	2.2	0.0	1.7	13.3	5.9
		22	0.0	5.6	5.0	11.2	6.7	10.1	10.1	11.7	7.8	8.4	5.6	11.2	3.4	1.1	1.7	0.6	13.3	5.9
		23	0.6	5.1	8.4	7.9	9.6	10.1	11.8	7.9	7.9	11.2	3.4	7.9	5.1	1.1	1.7	0.6	12.9	5.7
		24	1.1	4.5	6.8	10.7	11.9	7.9	11.9	10.2	7.9	5.1	6.2	9.0	3.4	1.7	1.7	0.0	12.6	5.6
	ALL HOURS		1.0	4.5	7.2	10.9	9.6	10.3	10.1	8.4	6.6	6.2	4.9	10.3	4.5	3.6	1.1	0.8	13.2	5.9

SOURCE: GEORESEARCH, INC.

Table IV - 73

Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - CUT BANK (SPRING)

06/03/81 - 08/03/83

	CALM	WIND SPEED (MPH)															AV SPEED (MPH)	AV SPEED (M/SEC)	
		0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1-				
		2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0	30.0	35.0	40.0	>40.0			
WIND SPEED (METERS/SECOND)																			
	CALM	0.1-	0.9-	1.8-	2.7-	3.6-	4.5-	5.4-	6.3-	7.2-	8.1-	9.0-	11.2-	13.5-	15.7-	>17.9	AV SPEED (MPH)	AV SPEED (M/SEC)	
1	0.0	1.2	3.6	10.2	12.7	12.0	13.9	7.2	10.2	10.8	7.8	6.0	2.4	1.8	0.0	0.0	12.6	5.6	
2	0.6	0.6	4.2	12.0	12.0	15.7	9.6	9.6	10.8	9.0	4.8	7.2	2.4	1.2	0.0	0.0	12.2	5.5	
3	0.0	1.8	5.4	12.0	14.5	11.4	11.4	13.3	6.0	6.0	4.8	7.8	3.6	0.6	1.2	0.0	12.3	5.5	
4	0.0	3.0	10.2	9.6	11.4	13.9	7.8	13.9	8.4	5.4	4.8	6.6	2.4	1.8	0.6	0.0	11.7	5.2	
5	0.0	2.4	8.4	12.7	17.5	11.4	12.7	10.2	3.6	7.2	6.0	5.4	1.8	0.6	0.0	0.0	10.9	4.9	
6	0.0	3.0	8.4	15.7	17.5	8.4	7.8	10.8	12.0	5.4	6.6	1.8	2.4	0.0	0.0	0.0	10.6	4.7	
7	0.0	3.6	10.2	8.4	21.7	13.9	12.0	6.0	9.0	9.6	1.2	0.6	3.0	0.6	0.0	0.0	10.2	4.6	
8	0.0	3.6	7.8	13.9	12.0	15.7	13.3	12.7	4.2	4.8	5.4	3.0	3.0	0.6	0.0	0.0	10.6	4.7	
H	9	0.0	3.6	9.6	9.6	13.3	13.9	12.7	10.2	6.0	6.6	2.4	7.8	1.8	1.8	0.6	0.0	11.3	5.1
O	10	0.0	2.4	7.3	8.5	9.1	12.7	13.3	12.1	4.8	6.1	5.5	13.9	2.4	1.2	0.6	0.0	12.8	5.7
O	11	0.0	1.2	4.8	7.3	9.1	9.7	13.9	8.5	9.1	8.5	6.1	13.3	6.1	2.4	0.0	0.0	14.2	6.4
U	12	0.0	1.2	4.2	4.2	8.5	9.1	10.9	13.3	12.1	7.9	5.5	13.9	5.5	1.2	1.2	1.2	15.0	6.7
U	13	0.0	1.2	4.2	4.8	6.6	6.6	13.8	17.4	7.8	7.8	8.4	10.8	4.8	3.6	1.8	0.6	15.3	6.8
R	14	0.0	1.2	2.4	5.4	9.0	8.4	13.8	10.2	12.6	7.2	3.0	15.0	5.4	3.0	1.8	1.8	15.8	7.1
R	15	0.0	1.2	1.2	7.2	5.4	10.2	13.8	10.8	6.0	9.6	9.0	12.6	6.6	3.0	2.4	1.2	16.0	7.2
	16	0.0	1.8	0.6	7.2	10.8	7.8	12.0	9.6	6.6	7.8	6.0	16.8	6.0	4.8	0.6	1.8	16.1	7.2
	17	0.0	0.6	0.6	7.8	12.0	10.8	7.2	11.4	4.2	6.0	9.0	17.4	7.2	4.2	1.2	0.6	16.0	7.2
	18	0.0	0.6	3.0	6.6	9.0	9.6	8.4	9.0	6.6	6.0	7.2	22.8	4.2	5.4	1.8	0.0	16.2	7.3
	19	0.0	2.4	1.8	4.2	10.2	9.6	10.2	9.6	6.0	7.8	8.4	16.9	7.8	4.8	0.0	0.0	15.9	7.1
	20	0.0	0.6	4.3	2.4	9.8	10.4	9.8	13.4	10.4	7.3	7.3	16.5	3.0	4.3	0.6	0.0	15.1	6.8
	21	0.0	1.8	1.8	6.1	6.7	13.4	12.8	12.8	9.8	10.4	8.5	11.0	3.0	1.8	0.0	0.0	14.0	6.3
	22	0.0	0.6	3.0	6.7	9.1	12.8	16.5	11.6	12.8	6.1	5.5	11.0	3.7	0.6	0.0	0.0	13.4	6.0
	23	0.0	0.0	4.3	6.7	9.1	14.6	10.4	17.1	9.8	11.0	9.1	6.1	0.0	1.8	0.0	0.0	12.9	5.8
	24	0.0	0.6	4.3	9.1	11.6	12.2	12.8	10.4	12.2	6.7	4.3	13.4	0.6	1.8	0.0	0.0	12.8	5.7
ALL HOURS		0.0	1.7	4.8	8.3	11.2	11.4	11.7	11.3	8.4	7.5	6.1	10.7	3.7	2.2	0.6	0.3	13.5	6.0

SOURCE: GEORESEARCH, INC.

Table IV - 74
Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - CUT BANK (SUMMER)

06/03/81 - 08/03/83

	CALM	WIND SPEED (MPH)														AV SPEED (MPH)	AV SPEED (M/SEC)
		0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1->40.0		
		2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0	30.0	35.0	40.0		
WIND SPEED (METERS/SECOND)																	
	CALM	0.1-	0.9-	1.8-	2.7-	3.6-	4.5-	5.4-	6.3-	7.2-	8.1-	9.0-	11.2-	13.5-	15.7-	>17.9	(MPH)(M/SEC)
		0.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.0	8.9	11.2	13.4	15.6	17.9		
1	0.0	0.6	3.4	9.1	21.0	17.0	11.4	11.9	11.4	6.8	4.5	1.7	0.6	0.6	0.0	0.0	10.9 4.9
2	0.0	0.6	3.4	12.5	17.6	15.9	16.5	10.2	8.0	10.2	3.4	1.1	0.0	0.6	0.0	0.0	10.7 4.8
3	0.0	1.1	5.7	15.3	15.9	19.9	11.9	8.0	8.5	5.1	4.0	3.4	0.6	0.6	0.0	0.0	10.4 4.6
4	0.0	2.8	10.2	11.4	21.6	15.3	11.9	9.7	5.7	2.8	2.3	5.7	0.6	0.0	0.0	0.0	9.7 4.3
5	0.0	2.3	8.5	14.8	21.6	14.8	11.9	8.0	8.0	4.0	2.3	2.8	1.1	0.0	0.0	0.0	9.6 4.3
6	0.0	1.7	14.2	18.8	17.6	13.1	8.0	6.8	5.7	6.3	2.8	4.5	0.6	0.0	0.0	0.0	9.2 4.1
7	0.0	3.4	13.1	15.9	19.3	11.4	13.1	8.5	4.5	4.5	1.7	4.0	0.0	0.6	0.0	0.0	9.1 4.1
8	0.0	2.8	17.6	14.8	15.9	10.2	9.7	8.5	4.5	6.3	4.0	5.1	0.6	0.0	0.0	0.0	9.5 4.2
H	9	0.0	2.3	10.8	18.8	14.2	12.5	9.1	8.5	6.3	5.7	3.4	6.8	1.7	0.0	0.0	10.2 4.6
O	10	0.0	2.3	8.0	18.2	16.5	8.0	6.3	10.2	6.3	8.0	6.3	6.3	3.4	0.6	0.0	0.0 11.3 5.0
O	11	0.0	2.3	5.1	10.3	15.4	16.0	7.4	9.7	5.7	7.4	4.6	9.7	3.4	2.9	0.0	0.0 12.4 5.6
U	12	0.0	0.0	4.0	15.0	12.1	12.7	9.8	9.2	9.8	5.2	5.8	9.8	3.5	2.9	0.0	0.0 12.9 5.8
U	13	0.0	0.0	4.0	10.8	13.1	11.9	13.1	6.3	8.0	7.4	8.5	10.2	3.4	2.3	1.1	0.0 13.6 6.1
R	14	0.0	0.0	2.8	13.1	15.9	9.7	8.5	7.4	4.0	9.1	9.1	11.4	5.1	2.8	0.6	0.6 14.0 6.2
R	15	0.0	0.0	1.1	12.5	14.8	10.2	9.7	9.7	6.8	4.0	7.4	13.6	4.5	4.5	0.6	0.6 14.3 6.4
R	16	0.0	0.0	0.6	9.7	10.2	14.2	10.8	13.6	7.4	6.3	5.7	12.5	4.5	2.8	1.1	0.6 14.5 6.5
R	17	0.0	0.0	1.7	4.0	11.4	13.1	12.6	10.9	12.6	5.1	7.4	13.7	2.3	4.0	0.0	1.1 14.8 6.6
R	18	0.0	0.0	0.0	4.6	11.4	13.7	9.7	12.6	9.7	7.4	6.3	17.7	4.6	1.1	0.0	1.1 15.0 6.7
R	19	0.0	0.0	0.6	5.1	8.0	9.7	13.1	8.0	10.9	12.6	8.0	17.7	4.0	1.7	0.0	0.6 15.5 6.9
R	20	0.0	0.0	0.6	5.1	6.9	10.3	10.9	12.6	8.6	12.0	9.1	18.3	3.4	1.7	0.0	0.6 15.5 6.9
R	21	0.0	0.0	1.7	4.0	6.3	14.3	14.9	13.7	8.0	12.6	8.6	13.7	0.6	0.6	0.6	0.6 14.4 6.4
R	22	0.0	0.0	2.3	4.6	12.6	17.1	16.0	15.4	9.7	6.3	4.6	9.1	1.1	0.6	0.0	0.6 12.7 5.7
R	23	0.0	0.0	1.7	10.3	13.7	13.1	14.9	16.6	7.4	12.0	5.7	3.4	0.0	0.6	0.6	0.0 12.0 5.4
R	24	0.0	1.1	5.7	8.6	13.8	18.4	12.1	10.9	12.6	7.5	5.7	2.3	1.1	0.0	0.0	11.2 5.0
ALL HOURS		0.0	1.0	5.3	11.1	14.5	13.4	11.4	10.3	7.9	7.3	5.5	8.5	2.1	1.3	0.2	0.3 12.2 5.5

SOURCE: GEORESEARCH, INC.

Table IV - 75
Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - CUT BANK (AUTUMN)

06/03/81 - 08/03/83

		WIND SPEED (MPH)																		
		CALM	0.1-	2.1-	4.1-	6.1-	8.1-	10.1-	12.1-	14.1-	16.1-	18.1-	20.1-	25.1-	30.1-	35.1-	>40.0	AV	AV	
		CALM	0.1-	0.9-	1.8-	2.7-	3.6-	4.5-	5.4-	6.3-	7.2-	8.1-	9.0-	11.2-	13.5-	15.7-	>17.9	SPEED (MPH)	SPEED (M/SEC)	
141	1	0.7	2.2	4.5	13.4	14.2	17.9	10.4	11.9	8.2	6.7	2.2	7.5	0.0	0.0	0.0	0.0	10.8	4.8	
	2	0.7	1.5	6.7	11.2	15.7	12.7	17.2	12.7	5.2	6.0	6.0	4.5	0.0	0.0	0.0	0.0	10.7	4.8	
	3	0.7	4.5	6.7	10.4	13.4	16.4	14.9	8.2	4.5	9.0	7.5	3.0	0.7	0.0	0.0	0.0	10.6	4.7	
	4	0.8	1.5	8.3	14.3	16.5	15.0	8.3	9.8	5.3	7.5	1.5	9.0	2.3	0.0	0.0	0.0	10.7	4.8	
	5	0.8	0.8	9.1	15.2	13.6	16.7	15.2	7.6	6.8	6.1	3.0	3.0	1.5	0.8	0.0	0.0	10.2	4.6	
	6	0.8	0.8	12.1	14.4	16.7	9.8	13.6	6.8	11.4	6.1	3.0	3.0	1.5	0.0	0.0	0.0	10.1	4.5	
	7	0.8	2.3	10.6	13.6	18.2	13.6	7.6	11.4	4.5	7.6	3.0	4.5	2.3	0.0	0.0	0.0	10.1	4.5	
	8	0.8	1.5	9.8	18.2	14.4	13.6	9.1	5.3	9.1	4.5	3.0	9.1	1.5	0.0	0.0	0.0	10.3	4.6	
	H	9	0.8	3.0	8.3	15.9	22.0	7.6	6.8	9.1	4.5	6.8	7.6	6.1	0.8	0.8	0.0	0.0	10.5	4.7
	10	0.8	3.0	15.2	13.6	10.6	12.1	12.9	8.3	3.8	6.1	3.8	8.3	0.8	0.8	0.0	0.0	10.2	4.6	
	O	11	1.5	2.3	11.4	16.7	10.6	11.4	9.1	6.1	8.3	7.6	3.0	9.8	1.5	0.8	0.0	0.0	10.8	4.8
	12	1.5	1.5	7.6	12.9	14.4	10.6	6.1	6.1	5.3	8.3	5.3	16.7	3.8	0.0	0.0	0.0	12.4	5.6	
	U	13	1.5	0.0	6.7	9.0	13.4	6.0	13.4	8.2	4.5	7.5	8.2	13.4	6.0	2.2	0.0	0.0	13.8	6.2
	R	14	1.5	0.0	3.7	8.2	9.7	12.7	9.0	6.0	6.0	9.0	9.7	15.7	2.2	6.0	0.7	0.0	14.9	6.7
	15	1.5	0.0	2.2	5.2	9.7	11.2	7.5	11.2	11.2	7.5	7.5	11.2	9.0	3.7	0.7	0.7	15.7	7.0	
	16	1.5	0.0	3.7	5.2	6.0	7.5	7.5	17.2	9.0	7.5	5.2	17.2	4.5	7.5	0.7	0.0	16.1	7.2	
	17	1.5	0.7	3.0	4.5	6.7	9.0	6.7	11.9	10.4	9.0	7.5	16.4	6.0	6.0	0.7	0.0	16.1	7.2	
	18	1.5	0.7	4.5	5.2	4.5	6.0	10.4	11.9	12.7	9.0	9.0	13.4	8.2	2.2	0.7	0.0	15.6	7.0	
	19	1.5	0.0	2.2	8.2	5.2	9.7	11.9	12.7	9.7	9.0	8.2	14.2	4.5	3.0	0.0	0.0	14.7	6.6	
	20	1.5	0.0	3.0	6.0	9.0	15.7	12.7	12.7	11.9	10.4	4.5	6.7	4.5	0.7	0.7	0.0	13.3	5.9	
	21	1.5	0.0	1.5	5.3	15.0	15.0	15.0	11.3	12.8	7.5	5.3	6.8	3.0	0.0	0.0	0.0	12.4	5.6	
	22	1.5	0.0	1.5	6.0	18.8	15.0	20.3	9.8	7.5	8.3	2.3	9.0	0.0	0.0	0.0	0.0	11.7	5.2	
	23	1.5	0.8	7.5	7.5	12.0	17.3	16.5	9.8	8.3	6.0	7.5	4.5	0.8	0.0	0.0	0.0	11.1	5.0	
	24	1.5	0.8	4.5	9.8	13.6	20.5	13.6	9.1	7.6	9.1	3.8	6.1	0.0	0.0	0.0	0.0	11.1	4.9	
ALL HOURS		1.2	1.2	6.4	10.4	12.6	12.6	11.5	9.8	7.9	7.6	5.3	9.1	2.7	1.4	0.2	0.0	12.3	5.5	

SOURCE: GEORESEARCH, INC.

Table IV - 76

Annual Wind Rose Distribution

GLACIER COUNTY - CUT BANK

06/03/81 - 08/03/83

DIRECTION>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	NNW	NW	NNW TOTAL	<DIRECTION	
	SPEED (MPH)															SPEED (M/SEC)		
0.1- 1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.1- 0.4	
1.1- 2.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	1.6	0.5- 0.9	
2.1- 3.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.1	0.3	0.2	0.1	2.1	1.0- 1.3 S	
3.1- 4.0	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.4	0.3	0.5	0.5	0.3	0.3	0.3	0.2	3.9	1.4- 1.8 P	
S 4.1- 5.0	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.2	4.2	1.9- 2.2 E	
P 5.1- 6.0	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.5	0.5	0.6	0.5	0.6	0.5	0.4	0.3	6.0	2.3- 2.7 E	
E 6.1- 7.0	0.3	0.2	0.3	0.2	0.2	0.1	0.2	0.4	0.4	0.4	0.4	0.5	0.6	0.4	0.3	5.2	2.8- 3.1 D	
E 7.1- 8.0	0.4	0.3	0.3	0.3	0.2	0.2	0.3	0.6	0.5	0.5	0.5	0.6	0.6	0.6	0.4	6.7	3.2- 3.6	
D 8.1- 9.0	0.4	0.2	0.2	0.3	0.2	0.1	0.3	0.5	0.3	0.3	0.3	0.4	0.5	0.5	0.4	5.2	3.7- 4.0 M	
9.1-10.0	0.4	0.3	0.4	0.4	0.2	0.2	0.3	0.5	0.8	0.5	0.4	0.3	0.6	0.6	0.4	6.7	4.1- 4.5 E	
M 10.1-11.0	0.3	0.3	0.4	0.3	0.1	0.1	0.2	0.4	0.5	0.3	0.3	0.2	0.4	0.4	0.3	0.2	4.7	4.6- 4.9 T
I 11.1-12.0	0.4	0.3	0.5	0.4	0.2	0.1	0.2	0.6	0.8	0.4	0.3	0.3	0.6	0.6	0.5	0.4	6.5	5.0- 5.4 E
L 12.1-13.0	0.3	0.3	0.4	0.3	0.2	0.1	0.2	0.6	0.6	0.2	0.2	0.3	0.4	0.4	0.4	0.2	4.8	5.5- 5.8 R
E 13.1-14.0	0.2	0.3	0.3	0.3	0.2	0.1	0.3	0.5	0.5	0.3	0.2	0.2	0.5	0.5	0.4	0.3	5.1	5.9- 6.3 S
S 14.1-15.0	0.2	0.3	0.3	0.2	0.2	0.1	0.2	0.5	0.4	0.2	0.1	0.2	0.3	0.5	0.3	0.1	4.1	6.4- 6.7 /
/ 15.1-16.0	0.2	0.2	0.4	0.2	0.1	0.1	0.1	0.3	0.3	0.1	0.1	0.1	0.3	0.4	0.3	0.2	3.6	6.8- 7.2 S
H 16.1-17.0	0.2	0.3	0.3	0.3	0.1	0.1	0.2	0.4	0.4	0.1	0.1	0.2	0.5	0.4	0.4	0.2	4.2	7.3- 7.6 E
O 17.1-18.0	0.2	0.2	0.2	0.1	0.0	0.0	0.1	0.3	0.2	0.0	0.1	0.2	0.4	0.3	0.2	0.1	2.9	7.7- 8.0 C
U 18.1-19.0	0.2	0.3	0.3	0.1	0.1	0.0	0.1	0.3	0.3	0.0	0.1	0.2	0.5	0.4	0.3	0.1	3.3	8.1- 8.5 O
R 19.1-20.0	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.2	0.1	0.0	0.1	0.2	0.3	0.3	0.2	0.1	2.1	8.6- 8.9 N
20.1-25.0	0.4	0.7	0.4	0.3	0.1	0.0	0.3	0.7	0.6	0.1	0.1	0.7	1.5	1.3	1.0	0.3	8.7	9.0-11.2 D
25.1-30.0	0.1	0.3	0.2	0.1	0.0	0.0	0.2	0.2	0.4	0.0	0.0	0.4	0.9	0.7	0.6	0.1	4.2	11.3-13.4
30.1-35.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.2	0.6	0.3	0.2	0.1	2.0	13.5-15.6
35.1-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.2	0.1	0.1	0.0	0.8	15.7-17.9
>40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.4	>17.9	
CALM																0.5 CALM		
TOTAL	5.0	5.2	5.6	4.7	3.1	2.4	4.1	7.2	9.6	5.3	5.3	7.0	11.5	10.5	8.3	4.6	100.0	
AV SPEED (MPH)	12.6	14.5	13.3	11.7	9.8	9.2	12.4	14.3	12.4	8.8	8.6	13.3	15.8	14.3	14.0	11.5	12.8	
AV SPEED (M/SEC)	5.6	6.5	5.9	5.2	4.4	4.1	5.6	6.4	5.6	3.9	3.8	6.0	7.1	6.4	6.3	5.1	5.7	
																	(M/SEC)	

SOURCE: GEORESEARCH, INC.

Figure IV - 8
Annual Wind Rose
GLACIER COUNTY - CUT BANK
(1981 - 1983)

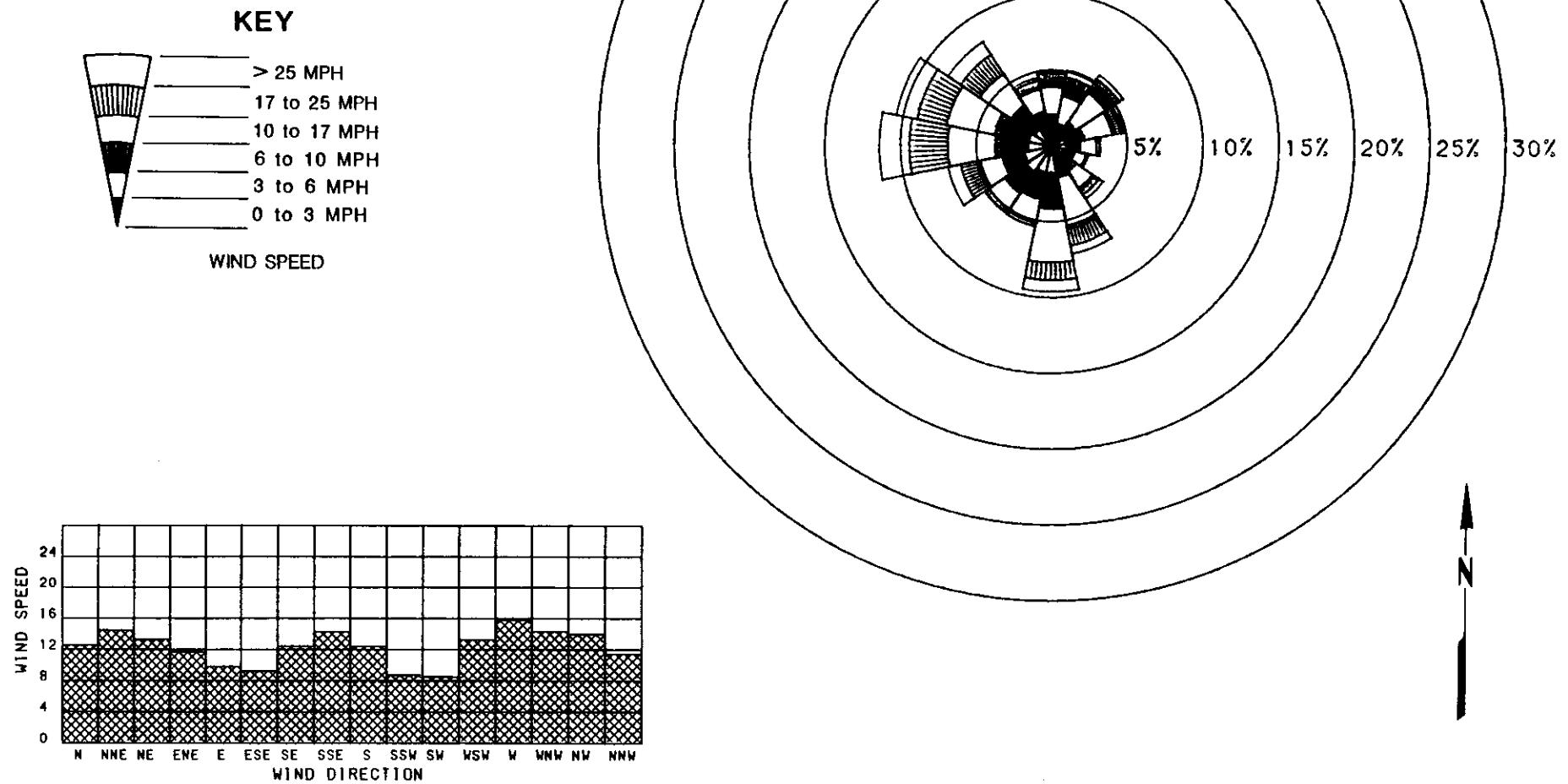


Table IV - 64
Coefficients of Weibull Distribution
GLACIER COUNTY - CUT BANK

06/03/81 - 08/03/83

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	6.5924	1.4589
FEBRUARY	6.7719	1.4816
MARCH	6.3517	1.9743
APRIL	6.1606	1.8728
MAY	7.1095	2.0800
JUNE	6.2660	1.9796
JULY	5.6903	2.0695
AUGUST	5.1465	1.8765
SEPTEMBER	6.0152	1.9066
OCTOBER	6.0286	1.8164
NOVEMBER	5.8882	1.9624
DECEMBER	6.1757	1.7187
YEAR	6.1787	1.8271

SOURCE: GEORESEARCH, INC.

CUT BANK FAA AIRPORT

GLACIER COUNTY

The Cut Bank airport is located about 5 miles south-southwest of Cut Bank at 48°36'00" N and 112°22'12" W (Site No. 56 on Map II-1). Elevation at the airport is 3,852 feet. Meteorological data have been collected at this site for many years by the Federal Aviation Administration.

Cut Bank is on the Great Plains about 40 miles east of the Rocky Mountain Front and about 50 miles west of the Sweetgrass Hills. The land around Cut Bank is used predominantly for agriculture. Most of the land is privately owned, although a few sections are owned by the state and federal governments. The Blackfeet Indian Reservation lies a few miles to the west. Interstate Highway 15 runs near the site, and many county roads cross the area.

Electrical service in the area is provided by Glacier County Electric Cooperative. A 115-kV transmission line runs east-west through Cut Bank. The nearest other commercial airport is at Shelby, approximately 25 miles to the east. Air traffic in the area is generally light.

Data for the site, collected primarily for aviation and weather forecasting uses, consist of short-term (5 minutes or less) averages of wind speed and wind direction, as well as other meteorological parameters. Data are gathered once per hour. The data have been analyzed by Battelle Pacific Northwest Laboratories. Because of a change in anemometer height, the data set was split into two parts for analysis: November 22, 1949, through October 3, 1959; and October 4, 1959, through December 31, 1978. Only data from the latter period were selected for inclusion in the *Montana Wind Energy Atlas*.

The data set for Cut Bank consists of summaries of observations made every third hour. The anemometer was mounted on a ground mast at a height of 6.1 meters. Data from the site are representative of a large portion of north-central Montana.

Average monthly wind speeds ranged from 10.3 miles per hour in July to 13.9 miles per hour in December and January. Average annual wind speed was 12.5 miles per hour.

Average monthly wind power varied from 118.0 watts/m² in July to 328.0 watts/m² in January. Average annual wind power was 228.0 watts/m².

Average seasonal wind speeds were 10.9 miles per hour in summer, 12.5 miles per hour in autumn, 13.0 miles per hour in spring, and 13.8 miles per hour in winter.

The highest average wind speeds occurred in mid-afternoon during all seasons except summer, when they occurred in late afternoon. The lowest average wind speeds occurred in early morning during all seasons. The diurnal range of average wind speeds was greatest in summer and least in winter.

The most common wind directions at this site were west-southwest and west. Winds from the east-northeast and south-southwest were least common. By direction, average wind speeds ranged from 8.1 miles per hour for winds from the northeast, east, and southeast, to 18.6 miles per hour for winds from the west-southwest. The highest average wind speeds were associated with winds from the prevailing wind directions.

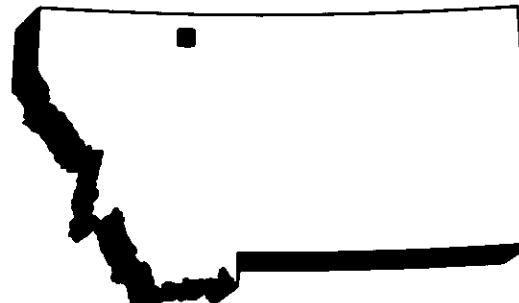


Table IV - 78
Monthly Wind Speed Distribution
GLACIER COUNTY - CUT BANK FAA AIRPORT

10/04/59 - 12/31/78

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM (<1.1)	6.8	6.4	5.6	5.6	4.5	5.2	6.3	7.2	7.9	6.3	6.8	7.3	6.3	CALM (<0.5)
1.1- 3.1	1.1	0.9	1.2	0.7	0.8	0.8	0.8	0.7	1.3	1.1	0.9	1.4	1.0	0.5- 1.4
3.4- 5.4	9.0	9.7	8.7	6.8	6.8	8.6	10.8	10.6	9.8	7.3	8.9	9.1	8.8	1.5- 2.4 S
S 5.6- 7.6	12.1	11.4	12.1	11.3	12.3	14.6	18.4	17.5	14.7	11.7	12.2	10.7	13.2	2.5- 3.4 P
P 7.8- 9.8	10.6	11.4	13.6	13.6	15.3	15.8	18.2	18.0	15.8	11.5	13.0	11.4	14.0	3.5- 4.4 E
E 10.1-12.1	9.7	9.0	11.2	12.1	12.7	12.6	14.5	12.9	12.3	11.6	10.2	8.4	11.4	4.5- 5.4 E
E 12.3-14.3	8.0	8.2	9.0	10.7	10.1	10.0	8.7	9.3	9.9	9.8	8.9	7.6	9.2	5.5- 6.4 D
D 14.5-16.6	6.7	7.8	7.0	8.6	8.7	7.5	6.3	6.5	6.9	7.8	7.1	7.3	7.3	6.5- 7.4
16.8-18.8	7.7	7.7	7.1	8.1	8.4	8.2	5.8	6.4	6.9	8.7	9.8	7.8	7.7	7.5- 8.4 M
M 19.0-21.0	7.7	8.7	7.5	7.9	7.8	6.6	4.5	5.0	5.5	8.6	6.9	7.9	7.0	8.5- 9.4 E
I 21.3-23.3	6.7	7.0	6.3	5.1	5.2	4.3	2.6	2.9	3.9	6.6	5.5	7.7	5.3	9.5-10.4 T
L 23.5-25.5	3.5	3.6	3.4	3.0	2.6	2.0	1.2	1.1	1.5	3.4	3.0	3.9	2.7	10.5-11.4 E
E 25.7-27.7	3.2	2.2	2.3	2.1	1.8	1.3	0.7	0.7	1.5	2.1	2.0	2.5	1.9	11.5-12.4 R
S 28.0-30.0	2.9	2.3	2.1	1.8	1.5	1.4	0.7	0.7	0.9	1.8	2.0	2.7	1.7	12.5-13.4 S
/ 30.2-32.2	1.4	1.5	0.9	1.3	0.7	0.5	0.2	0.1	0.7	0.9	1.2	1.5	0.9	13.5-14.4 /
H 32.4-34.4	1.3	1.0	1.1	0.7	0.4	0.3	0.2	0.2	0.2	0.4	0.6	1.2	0.6	14.5-15.4 S
O 34.7-36.7	0.3	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.1	15.5-16.4 E
U 36.9-38.9	0.4	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.2	16.5-17.4 C
R 39.1-41.2	0.5	0.3	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.4	0.2	17.5-18.4 O
41.4-43.4	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	18.5-19.4 N
43.6-45.6	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	19.5-20.4 D
45.9-56.8	0.2	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	20.5-25.4
57.0-68.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.5-30.4
68.2-79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.5-35.4
79.4-90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5-40.4
>90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>40.4
AVERAGE SPEED (MPH)	13.9	13.6	13.2	13.2	12.8	11.9	10.3	10.5	11.2	13.2	13.0	13.9	12.5	
AVERAGE SPEED (M/SEC)	6.2	6.1	5.9	5.9	5.7	5.3	4.6	4.7	5.0	5.9	5.8	6.2	5.6	
AVERAGE WIND POWER (WATTS/M**2)	328.0	303.0	263.0	244.0	209.0	175.0	118.0	121.0	156.0	233.0	258.0	324.0	228.0	

ANEMOMETER HEIGHT = 20.0 FEET = 6.1 METERS

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 79

Percentage Frequency Summary for Wind Speed

GLACIER COUNTY - CUT BANK FAA AIRPORT (WINTER)

10/04/59 - 12/31/78

	WIND SPEED (MPH)														AV	AV			
	<0.5	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	SPEED	SPEED	
	<1.1	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2	(MPH)	(M/SEC)	
H	3	8.1	1.3	10.3	12.0	11.7	8.9	7.3	6.6	8.6	7.0	5.8	4.1	2.5	2.7	1.4	1.9	13.1	5.8
	6	8.0	1.3	10.9	11.7	11.6	8.4	8.3	7.1	7.3	6.9	7.2	3.1	2.5	2.0	1.4	2.3	13.0	5.8
O	9	8.9	0.9	11.5	10.6	10.3	8.9	7.9	8.6	6.8	7.7	6.1	3.8	2.6	2.2	1.5	1.8	13.1	5.8
	12	7.2	1.8	9.1	11.1	9.8	6.5	7.1	6.9	7.5	7.4	9.7	4.8	3.2	3.3	1.3	3.5	14.4	6.5
U	15	3.9	1.0	6.8	9.4	10.3	8.3	7.1	7.0	7.9	10.4	9.9	4.1	2.8	4.3	2.2	4.4	15.9	7.1
	18	4.8	0.7	7.6	11.1	12.2	10.2	8.6	7.0	8.6	9.2	7.5	3.1	2.9	2.3	1.4	2.8	14.3	6.4
R	21	6.4	0.9	7.8	12.6	12.4	11.3	9.2	7.6	7.2	9.2	4.7	2.3	2.2	2.3	1.3	2.4	13.3	5.9
	24	7.4	1.3	10.0	12.7	10.3	9.7	8.1	7.2	8.0	6.8	6.5	4.0	2.5	1.8	1.4	2.3	13.2	5.9
ALL HOURS		6.8	1.1	9.3	11.4	11.1	9.0	7.9	7.2	7.7	8.1	7.1	3.7	2.6	2.6	1.5	2.7	13.8	6.2

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 80

Percentage Frequency Summary for Wind Speed

GLACIER COUNTY - CUT BANK FAA AIRPORT (SPRING)

10/04/59 - 12/31/78

	WIND SPEED (MPH)															AV	AV		
	<0.5	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	SPEED	SPEED	
		1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	9.4	10.4	11.4	12.4	13.4	14.4	(MPH)	(M/SEC)		
	<1.1	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2			
		3.1	5.4	7.6	9.8	12.1	14.3	16.6	18.8	21.0	23.3	25.5	27.7	30.0	32.2				
H	3	8.6	1.7	10.0	15.4	15.3	12.0	10.1	7.3	6.1	6.1	3.1	1.4	0.9	0.7	0.5	0.8	10.8	4.8
	6	11.0	1.8	10.4	16.0	14.4	11.9	9.4	6.9	5.2	5.3	3.2	1.9	0.7	0.7	0.5	0.9	10.4	4.7
O	9	9.2	0.9	10.6	12.1	12.6	9.3	9.7	7.1	7.9	7.6	5.4	2.1	1.8	1.8	1.1	0.9	12.2	5.4
	12	2.6	0.5	6.1	9.1	12.8	12.3	8.6	8.4	8.9	9.8	6.3	3.9	3.7	3.3	1.6	2.2	14.9	6.7
U	15	1.5	0.5	4.6	8.7	10.9	10.3	8.8	9.6	9.6	9.6	9.2	5.0	3.3	3.8	2.1	2.7	16.2	7.2
	18	1.6	0.5	4.2	7.2	10.1	10.6	11.5	9.2	10.0	10.5	9.2	5.4	3.8	2.7	1.2	2.4	16.1	7.2
R	21	3.0	0.8	5.8	12.2	17.5	14.8	10.4	9.7	8.7	7.4	4.1	2.8	1.1	0.8	0.6	0.3	12.6	5.6
	24	4.2	0.7	7.7	14.6	19.8	14.8	11.2	6.5	6.5	5.7	3.9	1.5	1.3	0.6	0.4	0.6	11.6	5.2
ALL HOURS		5.2	0.9	7.4	11.9	14.2	12.0	9.9	8.1	7.9	7.7	5.5	3.0	2.1	1.8	1.0	1.3	13.0	5.8

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 81
Percentage Frequency Summary for Wind Speed
GLACIER COUNTY - CUT BANK FAA AIRPORT (SUMMER)

10/04/59 - 12/31/78

150		WIND SPEED (MPH)															AV SPEED (MPH)	AV SPEED (M/SEC)	
		<0.5	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-			
		1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	9.4	10.4	11.4	12.4	13.4	14.4	>14.4			
H	3	9.4	0.9	14.8	22.5	19.1	12.4	7.8	4.8	3.9	2.0	1.3	0.5	0.3	0.3	0.0	0.1	8.5	3.8
	6	13.5	0.8	16.3	21.3	16.9	12.0	8.4	3.6	3.2	1.9	1.0	0.4	0.4	0.2	0.1	0.1	7.9	3.5
O	9	9.9	1.5	14.0	16.2	14.8	10.2	7.1	7.0	7.4	5.7	2.5	1.7	0.7	0.8	0.2	0.5	10.1	4.5
	12	3.0	0.5	7.4	13.4	16.5	15.2	11.1	7.7	7.9	6.6	5.1	1.8	1.3	1.4	0.4	0.8	12.4	5.5
U	15	2.4	0.5	6.3	11.3	14.7	14.2	10.6	8.6	9.0	8.1	6.4	2.7	1.6	1.8	1.1	0.6	13.6	6.1
	18	2.4	0.6	5.3	11.6	12.3	12.8	9.9	9.7	11.4	10.3	5.6	3.4	1.9	2.0	0.4	0.7	14.0	6.3
R	21	4.1	0.6	6.3	16.7	21.5	14.5	10.7	7.9	7.4	5.1	2.8	0.8	0.6	0.8	0.0	0.2	11.2	5.0
	24	5.5	0.8	9.7	21.9	23.1	15.3	9.1	4.8	3.8	3.0	1.6	0.5	0.4	0.3	0.0	0.1	9.5	4.2
ALL HOURS		6.2	0.8	10.0	16.9	17.4	13.3	9.3	6.8	6.8	5.4	3.3	1.4	0.9	0.9	0.3	0.3	10.9	4.9

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 82

Percentage Frequency Summary for Wind Speed

GLACIER COUNTY - CUT BANK FAA AIRPORT (AUTUMN)

10/04/59 - 12/31/78

		WIND SPEED (MPH)															AV	AV	
		<0.5	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	SPEED	SPEED
		<1.1	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2	(MPH)	(M/SEC)
H	3	10.6	1.3	11.9	14.7	14.0	11.0	9.0	6.7	6.4	5.1	4.0	1.5	1.1	1.3	0.8	0.6	10.7	4.8
	6	12.7	1.5	12.5	15.9	12.5	9.6	8.2	6.7	6.8	5.2	3.9	1.5	1.0	0.7	0.5	0.7	10.2	4.6
O	9	13.1	1.8	12.1	12.8	11.9	9.9	8.4	7.0	7.2	5.8	4.1	2.4	1.4	1.0	0.5	0.4	10.7	4.8
	12	3.6	1.1	7.7	11.8	12.5	10.8	8.7	6.3	8.8	8.3	7.3	4.0	3.0	2.8	1.6	1.5	14.1	6.3
U	15	2.5	0.4	4.8	8.5	10.9	10.8	9.7	8.7	10.5	9.2	8.5	4.5	3.9	3.1	2.1	2.1	15.7	7.0
	18	3.2	0.9	4.5	9.3	13.3	10.0	10.6	8.3	12.1	10.2	8.2	3.8	2.6	1.8	0.8	0.9	14.6	6.5
R	21	4.5	0.5	6.4	13.9	16.8	15.4	12.3	8.1	7.7	6.6	3.3	1.3	0.9	1.3	0.6	0.6	12.0	5.4
	24	5.7	1.2	9.4	16.1	15.6	13.5	9.5	6.4	8.1	5.7	3.4	2.3	1.1	0.8	0.5	0.6	11.4	5.1
ALL HOURS		7.0	1.1	8.7	12.9	13.4	11.4	9.5	7.3	8.5	7.0	5.3	2.6	1.9	1.6	0.9	0.8	12.5	5.6

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

CUT BANK FAA AIRPORT — GLACIER COUNTY
Annual Wind Rose
(1959 - 1978)

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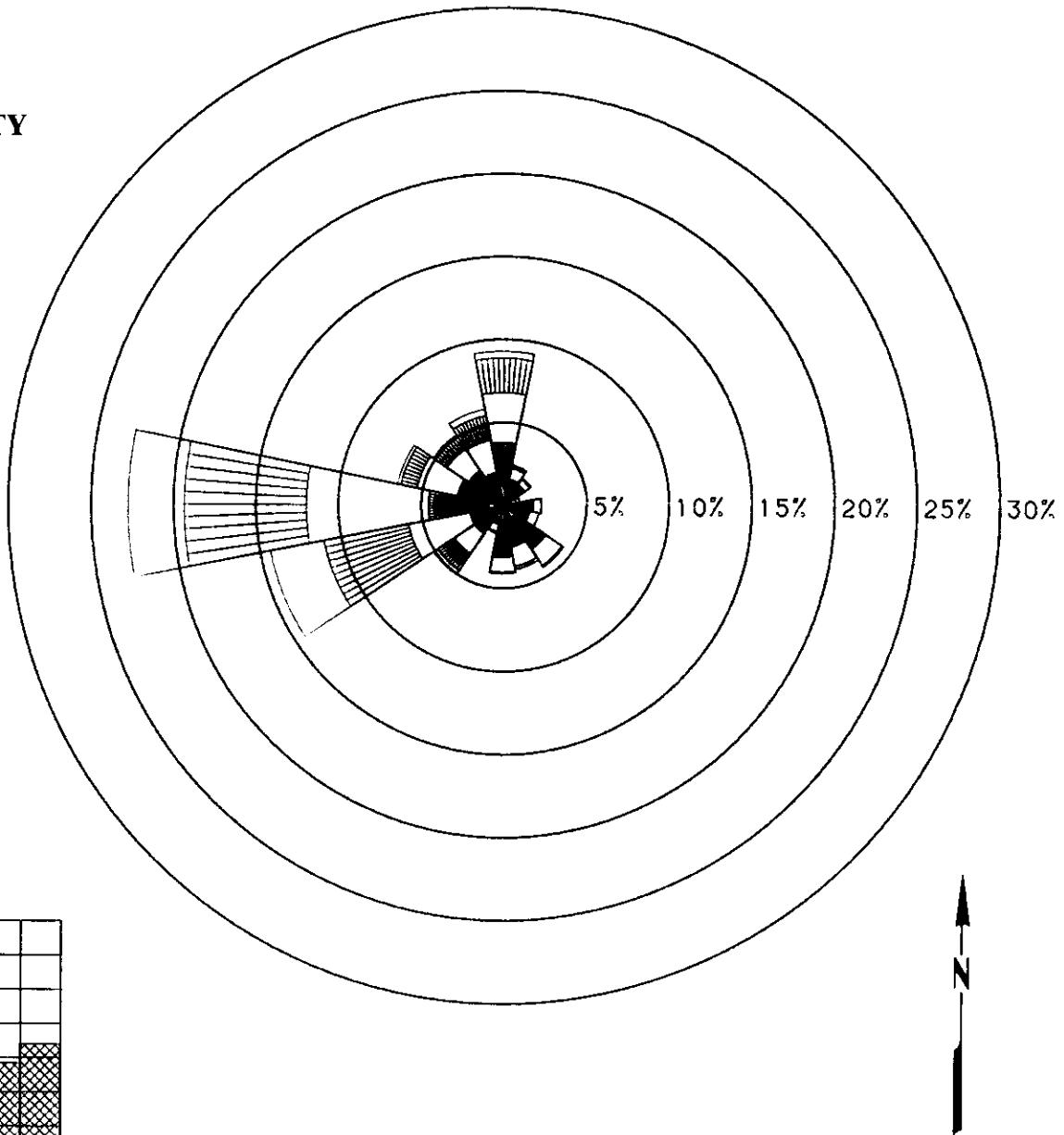
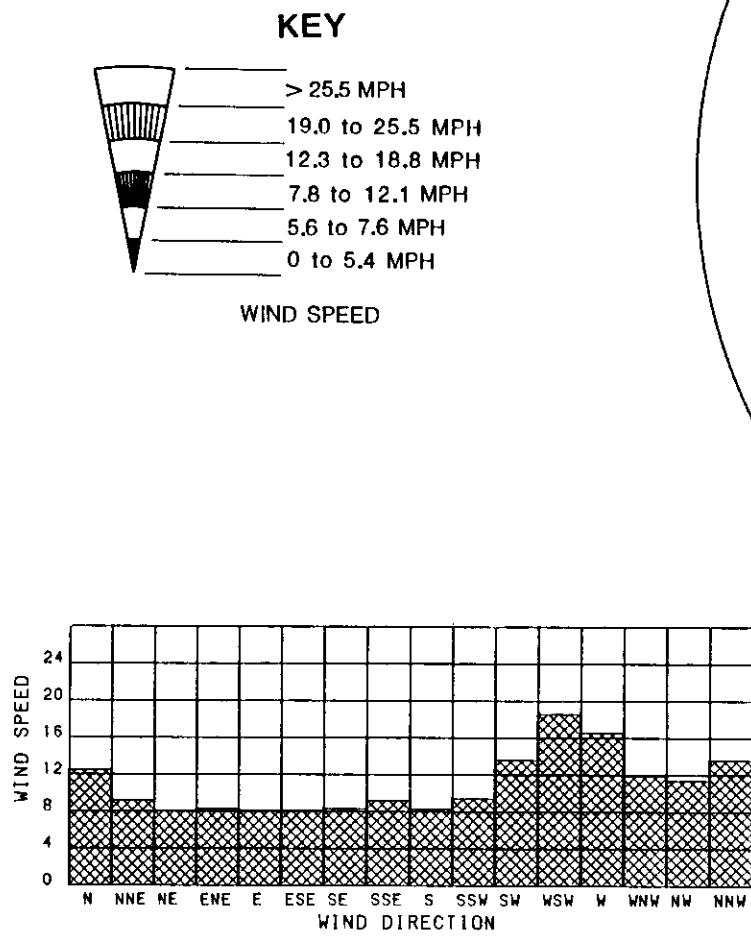


Table IV - 84
Coefficients of Weibull Distribution
GLACIER COUNTY - CUT BANK FAA AIRPORT
10/04/59 - 12/31/78

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	7.9270	2.1000
FEBRUARY	7.9290	2.1270
MARCH	7.5310	2.1560
APRIL	7.7180	2.3490
MAY	7.3050	2.4670
JUNE	6.9710	2.4340
JULY	6.2700	2.5470
AUGUST	6.3340	2.5960
SEPTEMBER	6.5610	2.3530
OCTOBER	7.3240	2.3990
NOVEMBER	7.6580	2.1690
DECEMBER	7.8490	2.0720
YEAR	7.3750	2.1980

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES